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THE ALTITUDE OF MOUNT HAMILTON.

During a study of the meteorological record kept by the Lick Observatory the attention of the writer was directed to a difference in the altitude of Observatory Peak as stated by different authorities. The following statements of the altitude of the mountain have been made, all referring to the marble floor of the main building:—

Altitude above mean sea level.	Stated by	Reference.
4209.46	Director HOLDEN	*A. S. P. Publ.*, 3, 370.
4209	U. S. Geol. Survey	Mt. Hamilton Sheet
4209	U. S. Geol. Survey	Bull. 274, p. 96.
4209	U. S. Wea. Bureau	Climatological Data for California.
4221	U. S. C. & G. Survey	Transcont. Trian., Spec. Publ. No. 4, p. 304; An. Rept., 1910, p. 398.

The first four of these statements are probably all the result of a line of precise levels run from the Southern Pacific track at the Market Street Station in San Jose in 1887 by a party of students of the College of Civil Engineering of the University of California under the direction of Mr. W. G. RAYMOND. The results of this survey were published in Volume III of these *Publications*. In a letter dated July 8, 1914, Professor RAYMOND states that "the elevation of the track at San Jose was gotten from the [Southern Pacific] Company. . . . The work was spirit leveling and its precision was pretty fairly close; . . . the probable error . . . was a very small fraction of a foot." The elevation given for the Market Street Station was stated in the report of this survey as 88.7 feet. The chief engineer of the Southern Pacific Company has informed the writer that the Market Street Station has not been changed since 1887. The elevation of the base of the rail at the station appears on the present railroad profile as 85.7 feet above the "S. P. zero," which is 5.7 feet above the datum plane of the United States Coast and Geodetic Survey, the mean of the lower low-waters. Mean sea-level at Goat Island, which is the nearest tide station to Oakland Pier, where the "S. P. zero" was compared with the Coast Survey datum plane, is about 3.4 feet above the Coast Survey datum plane. This makes the level of the track at the San Jose Market Street Station 88.0 feet above mean sea-level.

The discrepancy of 0.7 foot is not much greater than the difference between other precise level determinations in San Jose. For example, the elevation of the United States Geological Survey bench mark on the Hall of Records at the southwest corner of Saint James and First Streets. This bench mark has been determined by the Geological Survey as 98.317 feet above mean sea-level from a line of precise levels run from tide water and forming a closed circuit.[1] The same bench mark has been determined by the Coast and Geodetic Survey as 98.097 feet in the precise level net for which the results are not yet published.

The altitude of Mount Hamilton is stated in the "Dictionary of Altitudes in the United States," published by the United States Geological Survey, as 4209 feet; the authority for this altitude is the Geological Survey. The statement in regard to this authority is as follows:—

> A vast number of elevations are credited to this source. They have been determined by various means, but almost entirely by trigonometric methods and by level lines. Elevations of mountains, hills, and other points used as triangulation stations have, as a rule, been determined by trigonometric methods.[2]

The Mount Hamilton sheet of the Topographic Map of the United States, which is being issued in sheets by the Geological Survey, shows the altitude of Observatory Peak as 4209 feet. This sheet was surveyed in 1895 and the triangulation is stated as by the Coast and Geodetic Survey. In regard to the altitudes on this sheet the Topographic Branch of the Survey writes as follows:—

> The Mount Hamilton quadrangle was completely surveyed before Congress authorized the Geological Survey to run level lines and establish bench marks; consequently there were no bench marks set within that area.

The altitudes published by the Weather Bureau for its co-operative stations rest on data furnished by the co-operative observers when the stations are established and, therefore, the statement of 4209 feet by this authority must be regarded simply as a publication of the altitude determined by the Raymond party in 1887.

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[1] See Bul. 342, U. S. Geol. Survey, p. 126. Also Bul. 481, p. 66.

[2] U. S. Geol. Survey Bul. 274 (1906), p. 11.

The altitude of Mount Hamilton was determined by the United States Coast and Geodetic Survey by trigonometric leveling. The altitude is stated as 1298.9 meters (4262 feet) on top of the twelve-inch dome.

> The height of the small [12-inch] dome above the marble floor of the observatory is stated to be 40 feet 4 inches (12.3 meters); hence the height of the marble floor is 1286.6 meters or 4221 feet.[1]

In a letter dated June 19, 1914, the acting superintendent of the Survey states that—

> the elevation of Mount Hamilton, although placed in class 3 in "Triangulation in California, Part II," meaning that it was determined from non-reciprocal observations, has a probable error very much smaller than ten meters. This elevation was determined by vertical observations at five stations, at each of which there were observations on several days. The probable error of the elevation of Mount Hamilton, as contained in "Triangulation in California, Part II," is approximately one meter. The point determined was the top of the dome, as it existed in 1883-85.[2]

There seems to be no way at this time in which the two different altitudes for the mountain can be reconciled, nor any information which would cause the rejection of one or the other. Altho the line of precise levels was student work, Professor RAYMOND states that the probable error was very small and there is hardly any possibility that it could be as great as ten feet in the thirty miles from San Jose to the Lick Observatory. On the other hand, an error of this amount in the work of the Coast and Geodetic Survey is fully as difficult to understand. Precise levels were run to the top of Mount Diablo during the work of the Transcontinental Triangulation for the purpose of determining the value of refraction; this, together with the large number of observations, makes such an error seem out of the question.

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[1] The Transcontinental Triangulation by Charles A. Scott, U. S. Coast & Geod. Survey, Special Publication No. 4 (1910), p. 304. Also Triangulation in California, Part II, Ann. Rept. Supt. U. S. Coast & Geod. Survey for 1910, Append. 5 (1911), p. 398.

[2] This is the 12-inch dome, the 36-inch dome was not built at that time.

The altitude of Mount Hamilton is certainly just over 4200 feet, probably between 4209 and 4224. For practically all purposes this is as close as is necessary for actual use, altho it would be interesting to know the exact height of the mountain.

WILLIAM G. REED.

BERKELEY, CAL., September 3, 1914.

COLOR VARIATION OF THE CLUSTER-TYPE VARIABLE RS BOÖTIS.

The very. sudden and rapid increase in the brightness of cluster-type variables after the gradual decline to minimum suggests, if it does not demand for its explanation, some disturbance in the stellar atmosphere. Such a disturbance would almost certainly be accompanied by changes in the color of the light radiated by the star.

The matter has been put to a test in the case of the variable RS *Boötis,* whose period is 9^h 3^m and whose visual amplitude of variation, as shown by unpublished Laws Observatory observations, is approximately one magnitude. To avoid the influence of possible fluctuations in the light-curve, ordinary and isochromatic plates (the latter used with a yellow filter) were alternately exposed on three successive nights — July 16, 17 and 18, 1914—the instrument used being the 60-inch reflector. The exposures were, respectively, one minute and two minutes on the two kinds of plates. Five or six were made on each ordinary plate, and three or four on the isochromatic plates. A total of 85 plates and about 350 separate exposures cover the entire curve, with sufficient overlap from night to night to test the possibility of systematic differences between the three series of observations.

Five comparison stars covering an interval of about 2.5 magnitudes are available for the reduction of the measures of the variable. Their magnitudes on an absolute scale were established by varying the aperture for the different exposures. The apertures used were 32, 14 and 9 inches for the ordinary plates, and 60, 40 and 32 inches for the isochromatic plates.

Both the photographic and the photovisual scales were separately derived from the data of two nights. The difference in the magnitudes of the comparison stars for the two nights are: